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Distributed MIMO receiver - Achievable rates and upper bounds

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Abstract

In this paper we investigate the achievable rate of a system that includes a nomadic transmitter with several antennas, which is received by multiple agents, exhibiting independent channel gains and additive circular-symmetric complex Gaussian noise. In the nomadic regime, we assume that the agents do not have any decoding ability. These agents process their channel observations and forward them to the final destination through lossless links with a fixed capacity. We propose new achievable rates based on elementary compression and also on a Wyner-Ziv (CEO-like) processing, for both fast fading and block fading channels, as well as for general discrete channels. The simpler two agents scheme is solved, up to an implicit equation with a single variable. Limiting the nomadic transmitter to a circular-symmetric complex Gaussian signalling, new upper bounds are derived for both fast and block fading, based on the vector version of the entropy power inequality. These bounds are then compared to the achievable rates in several extreme scenarios. The asymptotic setting with numbers of agents and transmitter's antennas taken to infinity is analyzed. In addition, the upper bounds are analytically shown to be tight in several examples, while numerical calculations reveal a rather small gap in a finite 2×2 setting. The advantage of the Wyner-Ziv approach over elementary compression is shown where only the former can achieve the full diversity-multiplexing tradeoff. We also consider the non-nomadic setting, with agents that can decode. Here we give an achievable rate, over fast fading channel, which combines broadcast with dirty paper coding and the decentralized reception, which was introduced for the nomadic setting.

Index Terms

MIMO, Decentralized detection, wireless networks, Wyner-Ziv, CEO, compress-and-forward